Cement MILL SECTION of

Concrete

Vol. 28 June, 1926 No. 6

New Kilns and Waste Heat Boilers Put Early Mill in Class of Modern Plants

Well-known Peninsular Plant at Cement City, Michigan, Installs New 11x175 Foot Kilns and Waste Heat Boilers; First Experimented with Utilizing Waste Heat in 1903; Many Innovations in New Power House, Including Elaborate Recording Devices for Boiler Operation

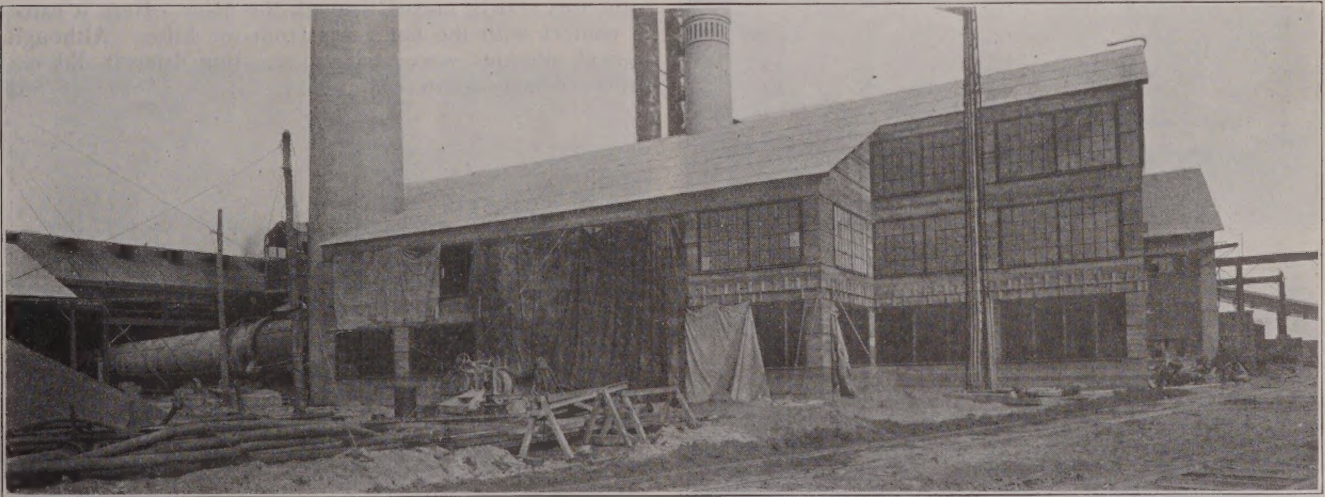
By L. N. DURYEA

The manufacturing of portland cement has been, perhaps to an even greater extent than most industries, the victim of its own initiative. The constant replacement of methods and machines has formed a chronological history of manufacturing improvements. In the short span of half a century since cement manufacturing was introduced into this country, there has been no one period of any appreciable length, until recent years, when the manufacturer could feel assured that his plant, no matter how new, was not going to be obsolete and even antiquated hardly before it had reached a healthy production.

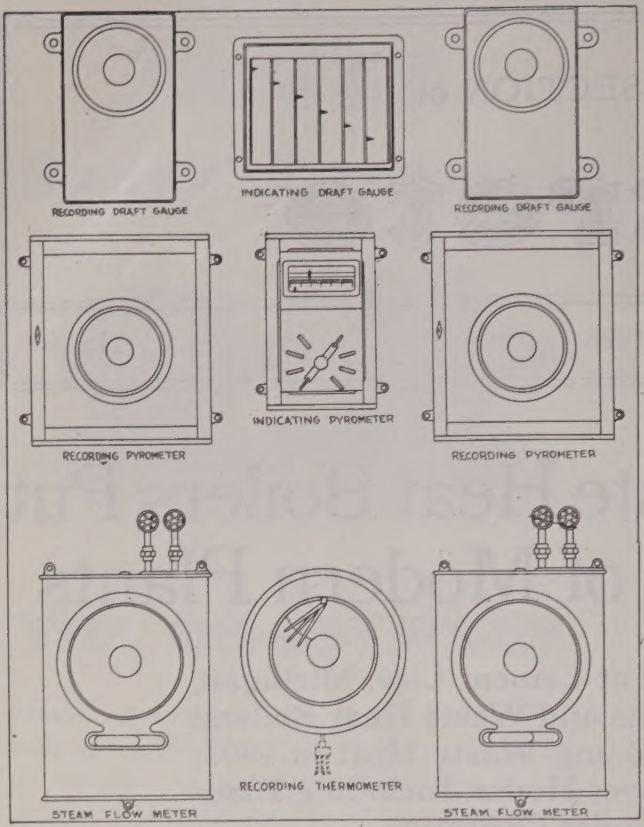
Naturally these changes have had their beneficial influences on the industry. Fortunately, however, the recent years have seen a tendency toward standardization and obsolescence is not the popular indoor sport that cement mill designers and machinery manufacturers would once make it.

Improvements will, no doubt, continue. They are the backbone of every industry and any manufacturer who refuses to recognize them is doomed.

Take the rotary kiln, for instance. Back in the early nineties when the vertical kiln was being gradually replaced by the then new and untried rotaries, a kiln 40 feet in length was a mammoth affair. Since then increases in length continued until it was almost necessary for a new plant to announce the longest kiln yet built to receive any



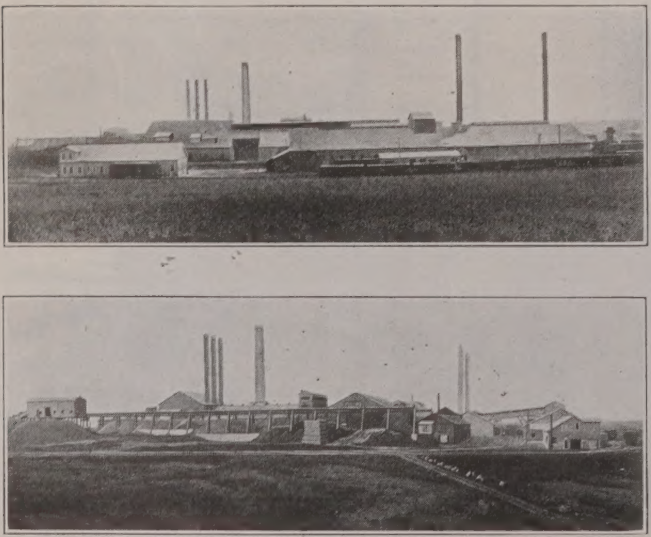
General view of power plant during course of construction. The stack cut-off in the immediate foreground is for direct discharge from the kilns or auxiliary boiler. The shorter stack through the roof of the building is for the induced draft through the boilers



Panel board for one boiler

attention whatsoever. However, the installations of long kilns have not been able to reduce the temperatures of the exhaust gases to the level that is being obtained with shorter kilns and waste heat boiler equipment. Two kiln installations contemplated will use kilns 330 feet long. It is doubtful whether these extremely long kilns will equal the waste heat boiler equipment in heat conservation.

These constant changes in methods and machines have caused many of the earlier plants to become the "also rans" of the industry. The plants that have failed to meet the changing modes of cement manufacturing have found constantly increasing difficulties in meeting the competition of the newer and more modern mills. The plants built in the nineties that have followed the new developments and are at the present time capable of classification as "a modern plant" are relatively few.



Two views of the Peninsular plant as it now appears

Old Plant Modernized

The Peninsular plant of the newly organized Consolidated Cement Corporation at Cement City, Michigan, formerly the Peninsular Portland Cement Company, stands out as a prominent example of early plants that can be classed today as a modern mill. The recent installation of two 11x175 feet kilns and a waste heat boiler plant has added the classification of modern plant to its distinction of being one of the first mills in the midwest district.

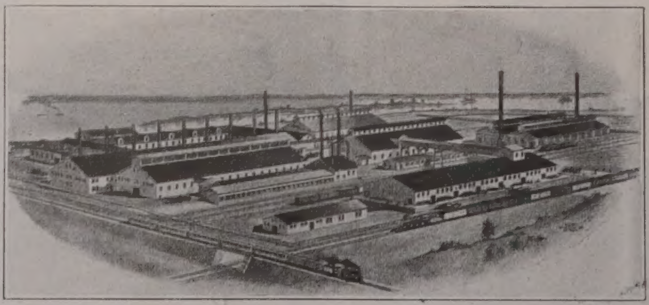
Throughout its history the Peninsular plant has taken a prominent part in introducing new ideas of manufacturing to the cement industry. It has the distinction of being the first plant in this country which is still operating to utilize individual electric drive for its various units. Long before waste heat boilers were conceived, an attempt was made to apply this very principle to the drying of the slurry that was used at that time for the raw mix. It is a coincidence that this plant which in 1903 attempted to make use of waste kiln gases should be equipped more than 20 years later with what many engineers have agreed is the most modern of waste heat installations.

The Peninsular Portland Cement Company was organized in 1899 by W. F. Cowham of Jackson, Michigan, who later became one of the biggest cement plant operators in this country and father of the present Cowham Engineering Company. The plant at the time of its construction was designed to use marl from one of the nearby lakes and clay from Bryan, Ohio. This plant was equipped with six 6x60 feet kilns.

In 1903 three 7x80 foot kilns were added to the original equipment. It was in connection with this installation that there was introduced what is believed to be the first attempt to utilize waste kiln gases in the cement industry. The marl and clay being used as raw materials were introduced into the kilns as in the modern wet process plant, but as this mixture averaged between 50 and 60 per cent moisture it resulted in inefficient kiln operation.

The Flat-Hearth Drier

With the installation of large kilns in 1903 it was proposed to dry the marl and clay and introduce the raw materials into the kilns as a dry mixture. To solve this problem a flat-hearth drier was constructed. This was a large brick tunnel 150 feet long and 25 feet wide with an arched top. The mixture of marl and clay was introduced into one end of the drier and by means of conveying equipment was slowly moved through the drier. Here it came in contact with the hot gases from the kilns. Although several attempts were made to use this drier it did not prove economical over a period of time. Parts of this



Architect's drawing of the plant now owned by the Consolidated Cement Corporation at Cement City, Michigan, as it was constructed in 1899 for the Peninsular Portland Cement Company. Since then many changes have been made in the layout and equipment of the mill drier had to be removed when foundations were placed for the new waste heat boiler and power house installation.

In 1915 the nine kilns were replaced by three 9x125 feet kilns, to which were added 7x80 feet sections, making three 205 foot kilns. These kilns are still part of the Peninsular equipment and until the starting of the new kilns about six weeks ago were the entire means of production. In the future these kilns will be used only as auxiliaries to the new installation.

The history of the electrical equipment of the plant is interesting. In the original plant Green-Wheelock cross compound reciprocating engines were installed. These operated 25-cycle General Electric generators, and in 1921 to this equipment was added a Westinghouse 2500 K.V.A. turbine. When the new equipment was recently installed 60-cycle equipment was introduced. Several of the original 25-cycle motors that were installed in 1899 and 1900 were still in use.

New Power Unit

The present new power installation consists of two complete Edgemoor waste heat boilers, one Edgemoor auxiliary boiler and two 1250 K. W. Allis-Chalmers steam turbines. Every known means of modernizing a power plant has been used with this installation. The building is a steel frame structure, surfaced with portland cement gunite and roofed with Johns-Manville corrugated asbestos. It is 145 feet long by 65 feet wide with a wing 111½x20 feet.

Ample provision has been made for increasing the capacity of the plant. A space of sufficient size to accommodate a third turbine has been allowed. The building is equipped with a Whiting overhead travelling crane of 20-ton capacity. A private office is provided for the chief engineer and assistant. Modern methods of lighting and intercommunication are provided.

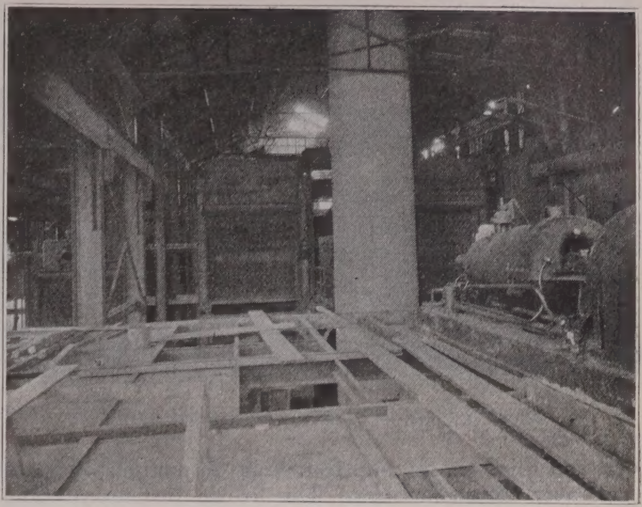
The waste heat boiler installation consists of two complete units, so arranged that practically any desired hookup is possible. Each boiler has 9000 square feet of heating surface with a Foster super-heater and a Foster economizer. The boilers are of the four-pass type with 330 tubes. The tubes are 25 feet in length and 4 inches in diameter. The boilers are designed to operate at 225 pounds per square inch working pressure.

The super-heating element has a guaranteed rise of steam temperature of 150 degrees F. when producing 22,500 pounds of steam per hour. The economizer has 3,885 square feet of heating surface.

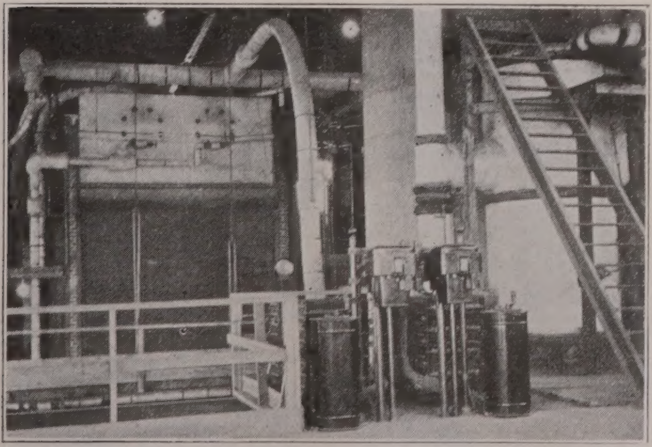
Waste Heat Boilers

The outstanding feature of this waste heat boiler installation is the intimate knowledge of operating conditions provided by the instrument panel layout. A complete record of both draft and temperature is maintained for all of the various stages between the kiln housing and the turbines. Electric pyrometers connected to the main panel board give complete information of operating temperatures. Constant check of these readings indicate any variance from proper operating conditions and show any leak in the boiler setting as well as an excessive accumulation of dust on the flues.

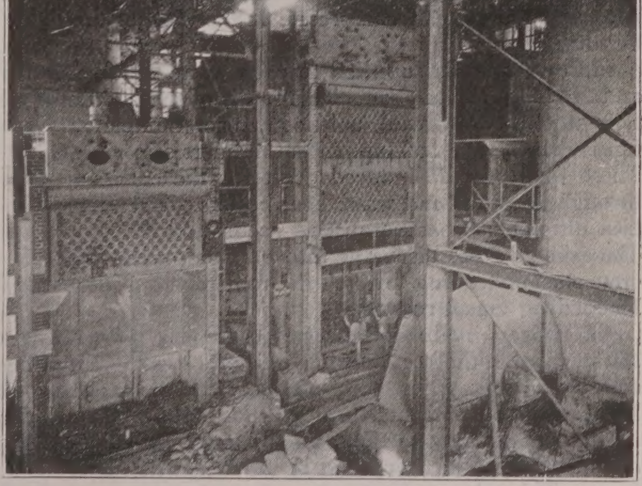
The recording board is equipped with nine instruments for each boiler. A Bailey Meter Company indicating draft gauge records the pressure of the kiln gases at six different points between the kiln housing and the exhaust fans. These points are first, in the main or common flue; second, at the bottom of first pass below the super-heater; third, at the bottom of first pass above the super-heater; fourth, at the bottom of second and third passes; fifth, at the bottom of fourth pass over the economizer, and sixth, at the back of economizer in the flue leading to the draft fan. The two Bristol recording draft gauges show, respectively, the draft in the kiln housing and in the flue leading to the exhaust fan. The Brown Instrument Company indicating pyrometer gives flash readings of the temperature of the gases first, entering the boiler; second, leaving the super-heater at bottom of first pass; third, at the bottom of sec-



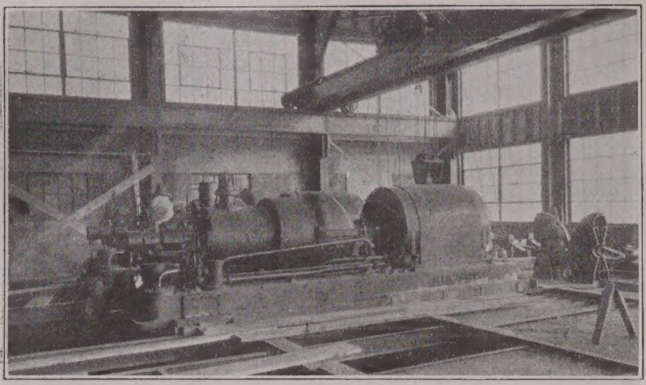
View of power plant installation from turbine floor during construction, showing auxiliary boiler to the left with main exhaust stack in center of photograph



Control boxes for motors operating draft fans for the waste heat boiler installation. Thirteen different speeds are possible



Photograph showing installation of the waste heat boilers and auxiliary boilers, with one of the two induced draft fans in the immediate foreground



Photograph showing installation of the turbines

ond and third passes, and fourth, at the bottom of fourth pass over the economizer. The Brown Instrument Company recording pyrometers record, respectively, the temperature of gases leaving the kiln housing and the temperatures of gases in the flue leading to the exhaust fan. The Brown Instrument Company indicating thermometer records the temperature of the super-heated steam at superheater outlet, the temperature of water leaving the economizer and the temperature of the water entering the economizer. The Bailey Meter Company steam flow meters record and integrate the steam flow and record the steam pressure between the boiler and the steam header and between the steam header and the turbine, respectively. When under normal operating conditions, readings will be taken and recorded at regular intervals.

Control Flues

Between the kilns and the boilers, control flues are so arranged that any combination of operation is possible. Either one or both boilers may be operated from either one or both kilns.

The kiln housings are connected through dampers with the common flue to which are also connected the gates for each boiler. This flue is 7 feet wide and 22 feet high, extending the width of the boiler house and connecting with the natural draft chimney.

The natural draft stack is of monolithic concrete construction, 157 feet high and with a 10-foot diameter at the top. To this stack is also connected the auxiliary boiler for starting and shut-down purposes.

The auxiliary boiler is an Edgemoor water tube type with 3,477 square feet of heating surface. It has 122 tubes and is equipped with a McClave-Brooks shaking grate. It is located with the air compressor in the wing of the power building.

Induced draft is supplied to each waste heat boiler by an individual exhaust fan. This fan is of the paddle wheel type built by the Green Fuel Economizer Company. Each fan is driven by a 150 h.p. Allis-Chalmers slip ring motor. These fans provide induced draft for the entire distance through the kilns and waste heat boilers. They have thirteen different speeds permitting accurate draft regulation. The exhaust gases discharge into a 72-foot monolithic concrete stack extending through the roof of the power house.

Recording Gas Pressures

An Ellison inclined draft gauge records the pressures of the gases in the kiln housing and indicates the operating conditions of the kilns. Close communication is maintained between the burning platform and the boiler house. Under normal working conditions the pressure of the entering combustible in the firing end of the kiln will remain constant. This places the burden of correct kiln operation upon the employees of the boiler room and requires close communication between the two departments. The day the plant was visited by the writer one kiln was shut down for inspection. However, due to a heavy load in the finish grinding department of the mill both boilers and turbines were operating. The operating kiln maintained a pressure of .23 inches of water at the kiln housing. Under usual operating conditions when all kilns, waste heat boilers and turbines are in use, the average pressure in the kiln housing is .3 inches of water. The temperature at this stage varies between 1250 and 1300 degrees F. while the temperature of the gases leaving the boiler is between 475 and 500 degrees F.

The turbines are 1250 k.w. capacity at 80 per cent power factor. They are the reaction three-stage type with bleeder connections for heating purposes. The generators are 3-phase, 2300-volt, 60-cycle, equipped with Griscomb Russell air coolers. Operated at 100 per cent power factor, the maximum capacity is 1560 k.w. each.

With the exception of the air compressor, the condenser is the only equipment to be reclaimed from the old installation. The condenser is of the surface type with 6000 square feet of cooling surface and operates a vacuum of 28-inch hg.

To minimize the pitting in the boiler tubes, deaerated water is furnished to the boiler by an Elliott deaerating heater. At present the plant is using from 5 to 8 per cent of make-up water but it is expected that this amount will be decreased as more constant operating conditions are obtained.

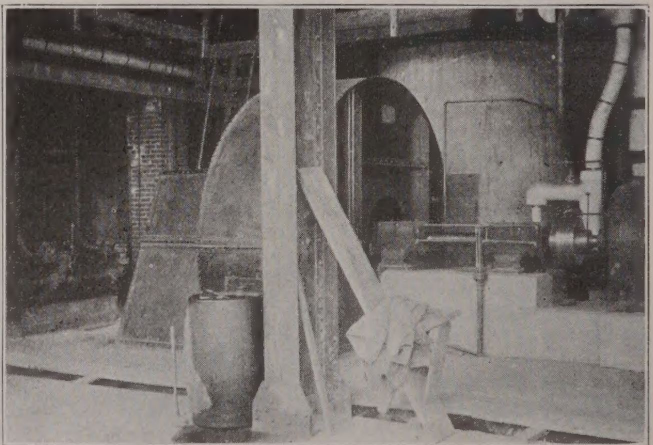
Some Operating Data

While this plant has been in operation only six weeks, some interesting operating data have been obtained. While it is yet early to establish conclusively the economies provided by the installation, an early check indicates a considerable saving. The water rate of the new turbines with auxiliaries has been determined as follows:

At 625 K.W.	16.45 pounds per hour
At 937 K.W.	15.8 pounds per hour
At 1250 K.W.	14.9 pounds per hour

In comparison with this the water rate for the old installation was approximately 26 pounds of steam per hour. Without attempting to discuss the economies of the installation except from a standpoint of labor and fuel, the saving from these two sources alone indicates a considerable reduction in operating costs.

In the matter of fuel consumption a comparison has been based on the amount of coal per barrel of clinker burned during 1925 for both kiln and power house consumption with that used during the first six weeks of operation of the new equipment. This comparison shows that 75.77 per cent of the amount of coal used by the old in-



Paddle wheel type fan providing draft for each kiln and waste heat boiler stallation per barrel of clinker burned was consumed by the new.

Labor Saving

In the matter of labor an appreciable saving is apparent. In the old power plant, sixteen employees were on the payroll. They consisted of:

One chief engineer.
One assistant chief engineer.
Two operators.
One oiler.
Four firemen.
Four coal passers.
Two boiler men.
One repair man.

With the new installation the power house personnel consists of:

One chief engineer.
Two operators.
Two oilers.
Two dusters.
One repair man.
One helper.
One extra.

This redistribution of labor represents a saving of $22.88 per day.

Compressed air lines are available near the boiler settings to remove the dust from the boiler tubes and flues. The accumulation of dust has been surprisingly small during the period of operation.

The Management

F. E. Dodge, chief engineer of the Cowham Engineering Company, designed and was in charge of the construction of this installation. J. E. Curtis is superintendent and Augustus Wittenberg is assistant superintendent. J. E. Kaminska is chief engineer and was field engineer in charge of construction. A. E. Selfe is assistant chief engineer.

The Peninsular plant has recently been merged along with the Fredonia Portland Cement Company of Fredonia, Kansas, and the Great Western Portland Cement Company of Mildred, Kansas, into the Consolidated Cement Corporation, of which John L. Senior of Chicago is president. The Cowham Engineering Company, who were engineers in charge of the installation, and now general managers of the Consolidated Cement Corporation, are in charge of operation at the plant.

With this new installation of kilns and waste heat boilers, the Peninsular plant has just claim of now being one of the most modern plants in operation.

Portland Cement Association Holds Spring Meeting

The spring meeting of the Portland Cement Association was held at the Biltmore Hotel in New York, May 17, 18 and 19. About 250 representatives from cement manufacturing companies located in all parts of the United States were present.

The first day of the meeting was devoted entirely to committee meetings and a meeting of the board of directors.

Tuesday, May 18, was given over to a discussion of technical problems and mill practice. At this session there were also presented the reports of the Committee on Accident Prevention and Insurance and the Committee on Conservation.

The truly remarkable accomplishments in the work of accident prevention accomplished by member companies aroused a great deal of interest and caused many expressions of commendation. The report of the Committee on Accident Prevention brought out the fact that the 1925 accident records showed 47 plants with lower accident figures than the best plant could claim in 1920. Also in 1925 there were two plants that operated the entire year without a single accident that resulted in lost time. In comparing the accident statistics of 1925 with those of 1924, it was found that in numbers of accidents there was an improvement of 23.5 per cent over 1924; in the number of days lost because of accidents there was a betterment of 15.7 per cent. Fatalities showed a decrease of 11.7 per cent. The exceptional progress made by the cement industry in the prevention of accidents is due largely to the very accurate records of accidents which are used as a basis for study by the committee.

Two interesting papers that provoked much discussion were read in the mill session. One of these, "Electric Shovels in Cement Quarry Operations" was read by J. F. Magee, division engineer of the Alpha Portland Cement Company, Easton, Pa. The other paper, "Development and Use of the Fuller-Kinyon Conveying System," was presented by Alonzo G. Kinyon, manager, conveying department, The Fuller Company, Catasauqua, Penn.

Wednesday's session was devoted to business matters. A feature of this session was the award of the safety trophy to the two companies that came through the year without lost time accidents. Two mills—the Duluth plant of the Universal Portland Cement Company and Plant No. 8 of the Canada Cement Company attained this unusual distinction. The Duluth plant operated 540 consecutive days without accident and the Canada Company plant operated 521 days without accident. To both of these plants the Portland Cement Association presented a concrete cast stone memorial, about 8 feet high and 6 feet wide, to be erected at the plant. Each of the winning plants was represented at the meeting by two delegates chosen from the employees at the plant. Photographs of the trophy were presented to these delegates by Richard Hardy, president of the Dixie Portland Cement Company, who acted as master of ceremonies. Gordon Huth and W. E. Bellingham were selected to represent the Duluth plant and S. H. Nichols and Harvey Brown were selected by the Canada plant. The delegates from the Canada plant were elected by popular vote and interest in the election ran high at the plant. All of the delegates were selected because of their activities in safety work at the plant they represented.

The dinner of the association was held on the evening of May 19 in the ballroom of the Biltmore. G. S. Brown president of the Alpha Portland Cement Company, and for many years prominent in the cement industry, acted as toastmaster. After dinner talks were made by the Hon. Hanford MacNider, assistant secretary of war, and Francis H. Sisson, vice-president, Guaranty Trust Company, New York. Assistant Secretary of War MacNider spoke on "Industrial Preparedness" and pointed out how the cement industry could be put on a war basis if the need should arise. Mr. Sisson mixed some very humorous stories with his thorough analysis of present business conditions and his sound forecast of the conditions under which the cement industry will be forced to do business in the future.

The meeting proper adjourned Wednesday evening with the close of the banquet, but there were still many old scores to settle on the golf links and Thursday was set aside for this purpose. The Seventh Annual Golf Tournament of the Portland Cement Association was held on that day at the Westchester-Biltmore Country Club, where stiff competition prevailed for the various prizes and trophies.

The Effect of Cement Dust on the Lungs of Cement Workers

Attitude on the Question—Review of Previous Studies—Detailed Description of a New Study Using X-rays for Observation—100 Men From 17 to 75 Years of Age Examined—Relation Between Dust-impregnated Lungs and Tuberculosis Discussed

By DR. FRITZ SCHOTT

Medical authorities are pretty well agreed that cement workers are in no greater danger from lung diseases than workers in other industries. Nevertheless this question comes up occasionally and new data on the subject are always interesting.

The following article is taken from a booklet, "Effect of Cement Dust on the Human Lung and the Problem of Tuberculosis Among Cement Workers," published by Zementverlag, Charlottenburg 2, Germany, in 1925. It describes a special clinical study in which the effect of cement dust on the lungs of workers in cement plants were investigated by X-ray observations. The data are from the Rohrbach Hospital and were collected by Dr. Fraenkel, Consulting Physician, and Dr. Hack, Physician in Charge.—The Editors.

The controversy between employees and employers over the 8 or 10-hour day directed public attention in Germany in the years following the war to the effect of inhaling dust. In this controversy the employees' unions claimed that dusty conditions excluded all possibility of longer working hours, while the employers, basing their attitude on extensive statistical data and medical advice, combated this argument or, at least, declared it one of minor importance. These contradictory conceptions, similar to those recently presented to public attention by the tobacco workers in Baden, show that even medical authorities are not unanimously agreed on this subject.

Independent of the economic and social problems, medical science—more particularly industrial hygiene and (since the discovery of the tuberculosis bacillus by R. Koch in 1882) tuberculosis research—has for a number of years made a study of the injurious effect of dust on the human organism, especially on the lungs, and its relation to tuberculosis.

If, during the first period of research, the workman in dust producing industries was considered especially sensitive to tuberculosis, a great deal has changed since and many erroneous views have been discarded. In spite of this, the belief that dust is injurious persists in many lay circles and, as will be shown below, with some reason. However, this belief does not apply to lime and cement dust. The older investigations on the effect of dust are mostly in the form of statistical data. Often based on erroneous assumptions, they cannot take their place with recent investigations. However, the extensive statistical material compiled has given rise to important conclusions.

X-Ray Shows New Evidence

Many problems were solved by making post mortem studies of lungs, but the information thus collected was not sufficient to permit the drawing of final conclusions. Only with the advent of the X-ray could studies of the changes produced in the lungs of living human beings by inhaling dust and of their relation to tuberculosis be made on a larger scale.

Particularly significant investigations were made in the porcelain industry by Harms and Holtzmann, Nay and Petri, Vollrath, and others. With the exception of a few authors (Kolsch) most investigators concluded that porcelain dust, consisting of kaolin, feldspar and quartz, while clinging to the lung and detectable by the X-ray, causes but very slight injuries in most cases. According to Rossle, porcelain dust in lungs and acute consumption do not occur together. Harms and Holtzman claim that tuberculosis does not play an important part in the porcelain industry and the workers having tuberculosis need not be advised to change their employment.

To quote but a few studies from other industries where dust is produced, similar favorable results were obtained in the Mansfeld Copper Mines (Ickert), in the coal basin of Westphalia on the Rhine (Patschkowski), etc. Notable is the extensive statistical material on the morbidity and mortality among mine workers in the Ruhr district by Heymann and Freudenberg. It appears that before the war, the mortality due to tuberculosis among miners in the Ruhr district was lower than in almost any other industry, which points to the low injuriousness of coal dust.

Sharp Grains Harmful

The injurious effect of quartz dust is generally recognized, the reason for which lies not only in the hardness and the sharp-edged structure of particles of this material, but also in its insolubility and biochemical properties. It is a matter of old experience that the lungs of a sandstone cutter show greatest changes and often a tendency to progressive consumption. Extensive investigations on this subject were made within the last years in American, English and South African quarry districts. These have also proven that quartz dust is especially injurious and have led to the noteworthy conclusion that mixing with clay makes quartz dust less harmful and hinders the progress of tuberculosis. For years lime dust was considered harmless by medical authorities. I will point only to Lehmann's data, according to which, of 28,000 men in 131 cement plants only one-third per cent showed incipient tuberculosis while 15 per cent showed cured germ foci. Just as favorable were data collected by Schultze. Statistics of the German Cement Union (Deutzcher Zement Bund) for 1924 gave similar results. The dust particles of quick lime are rounded and seldom have sharp edges. Lehmann classes limestone with rock dust of medium sharpness and hardness, and cement with the relatively dull-edged, soft to medium hard class, which also includes gypsum and clay. This author points particularly to the solubility of cement in carbonic acid solutions, thus explaining the remarkable fact that only small dust quantities are found in the lungs of cement workers employed for a number of years. The author found no exceptional differences in making microscopic investigations of raw mix, clinker and cement dust. All three types of dust have rounded, dull-edged, relatively large particles. Clinker dust, when rubbed with the fingers, appeared markedly harder than raw mix and cement dust.

Amounts Inhaled

Undoubtedly, in the course of years and decades spent in certain industries, considerable quantities of dust become accumulated in the breathing organs. Overbeck found that during a 10-hour day, 2 to 6 gm. of cement dust were inhaled daily by each worker. According to Ickert's investigations, miners with 40 years' experience in the Mansfeld Copper Mines inhaled about 48 gm. dust; those employed as stone cutters, 10 and 100 times this amount.

Of these dust quantities a large part (particularly of the dust entering through the nose and that in the bronchial tubes) is caught by tiny hairs and is eliminated in coughing. This is aided by an increased secretion and by continuous removal of epithelii of the secretion from the breathing tubes and its branches due to the irritation produced by the friction of the foreign matter, that is, of the dust particles. It is well known that a great many cement workers make it a habit to clear their throat from the collected dust by coughing at the close of day. The dust caught in the upper passages before it penetrates to the deeper-lying breathing organs is estimated by Lehmann as 50 per cent. He also points out that a large part of this dust is swallowed with the increased secretion and saliva.

In spite of these conditions, when a man is employed in a dusty atmosphere for tens of years, a considerable amount of dust becomes absorbed in the small bronchial tubes and in the lungs. A part of this, as mentioned above, becomes dissolved in the secretions of the lung containing carbonic acid; another part collects in the lung and finally becomes baked to a lump after traveling through the alveoli or, according to another source, through the bronchioli. A third part is absorbed by the so-called consuming cells (Fresszellen) and is brought into the membranes (Zwischengewebe) where the dust particles travel through the lymph canals to the lymph centers. The black coloring of the lymph centers at the root of the lungs in individuals living in coal dust regions is quite familiar even to the layman.

Finally, the amount of dust collected in the lungs and the membrane becomes sufficient to be easily recognized in an X-ray photograph.

Experiments with animals and a wealth of statistical data collected for years by plant physicians speak of the realtively harmless character of cement dust.

New X-Ray Studies

While X-ray diagnosis has been used in collecting statistics in the industries mentioned above, no such undertaking was known to me among workers in the cement industry.

This seemed to give added interest to conducting a series of clinical and X-ray studies on a large number of able-bodied and healthy workmen.

Age	Crushers	Mill	Kiln Room	Cement Mill	Packing Room	Others	Total
10-19	—	—	—	—	3	—	3
20-29	—	7	2	2	10	—	22
30-39	—	4	2	1	2	—	9
40-49	1	4	8	3	1	—	17
50-59	6	6	10	5	2	1	30
60-69	4	—	4	1	1	7	17
70-79	1	—	—	—	—	1	2
	12	21	27	12	19	9	100

Years of Work	Crushers	Mill	Kiln Room	Cement Mill	Packing Room	Others	Total
1-9	—	15	9	2	11	—	37
10-19	—	1	5	3	5	—	14
20-29	2	5	5	4	2	2	20
30-39	7	—	5	3	1	5	24
40-49	3	—	—	—	—	2	5
	12	21	27	12	19	9	100

When I began my program, I determined to include in the investigation not only all the weaker men in each section of the cement plant, but also the greatest possible number of older and oldest men.

Altogether the investigation included 100 men from the Leimen plant of the Heidelberg-Mannheim-Stuttgart Portland Cement Co. Among these the youngest one was 17; the oldest one 75 years old. The total working record varied between ½ and 48 years. The tables show the age and working period distribution for the different sections of the plant.

Conditions Considered

Past health record, thorough physical examination (tapping and stethoscope), blood test (the rate of settling of red corpuscles according to Linzenmeier) and X-ray photograph make up an accurate diagnosis of each workman.

The home conditions of these workmen could not be called bad considering the times. Most families live in 2 and 3-room apartments. In about 9 cases the space available was insufficient for the number of children. In 3 cases the conditions were poor. Some of the workmen live in houses built for that purpose by the plant. A great many of them have a small garden or a cultivated plot of land. It may be added that most workmen live in country places.

Records of pneumonia suffered during employment in the plant were rare. About 10 men could report this, which agrees with the usual number of inflammatory troubles of lungs and deeper-lying breathing organs of non-tubercular nature among men doing physical labor. Other troubles among men investigated were slight, even among the older men. Only a few complained of short breath, coughing and expectoration. Two men, whose lungs were shown by X-ray to have undergone greatest changes, had no complaint to make with reference to breathing organs. The severe lack of breath described as the characteristic sign of the "Miners' " or "Dust Sickness," was found in no case. No one had a pronounced consciousness of sickness.

Many Men Studied

Most workmen investigated were strong, muscular and well nourished men, a large number of whom had been in the service before the war. Naturally some toil-worn men were encountered among the older men of whom some were 70 years of age; it does not necessarily prove that they differed in this respect from men doing physical labor in other industries. The drop in working and earning capacity was due to age and wear and not to injury from inhaling dust.

The physical examination showed hardly anything aside from normal. Bronchial noise was heard in 16 men of whom almost all were older men and had been in the plant for years. Two of them, both 60 years of age, had pronounced bronchitis (the investigation took place during the summer months). The number of cases of enlargement of lungs (Emphysem) was 16 of which most were older or very old men and had done hard work for over twenty years. Typical symptoms of enlargement of the bronchial tube branches (Bronchiektasen) were found in one case. In 5 cases a simultaneous occurrence of bronchitis and dust in lungs was observed. The rest of the cases of bronchial catarrh had no dust deposits in the lungs. Similar is the relation between dust in lungs and emphysem. The fact was remarkable that men whose X-ray revealed presence of dust offered hardly any indication of it in the stethoscope examination. Hardly any disease symptoms were found in the other internal organs.

Three men, 60 to 70 years old, showed symptoms of extensive hardening of the arteries (Arterienverkalkung). One of these cases also had kidney trouble which, of course, had nothing to do with the inhaling of dust. The skin was clear in all cases. Eruptions or similar skin troubles, presumably caused by dust, were not observed. While the physical changes above the lungs are infrequent in spite of the years and tens of years spent in dusty atmospheres particularly in early life, the changes on the X-ray photographs are more frequent, yet slight compared to the considerable amounts of dust inhaled every day. The majority of the X-ray photographs showed no deviation from the normal conditions. One observes only, particularly in the case of older men, very marked lung contours which may be caused by impregnation with dust. However, I would not deem it advisable to class these cases often encountered in dust-free occupations, as "dust-impregnated lungs." (Staublunge.)

Conditions Revealed by X-Ray

Quite often X-rays showed an exceedingly wide, bulb-like enlarged lung root (Hilus) with a more pronounced outline towards the lung region. This change is to be considered normal. It was encountered almost entirely among laborers who had spent over ten years at the plant. One exceptional case was employed only 6 years. However, he had previously worked 15 years in a bakery, that is, also in dusty surroundings. Another case, an employee in the plant for only 8 years, had been in a cigar factory for 16 years. When the above-mentioned lung changes have been brought about, a dust impregnation of the lung tissue itself cannot be altogether denied. Ickert is right when he points out that fine specks visible on the lungs in the corpse are not detected by the X-ray.

Stronger phases of dust impregnation show a fine, granular or marble-like deposit on the center and lower regions of the lungs; the right lung being less affected due to anatomic conditions. With a few exceptions, all of these cases of pronounced dust deposits detected by X-ray had spent 20 years in the employment. The two men who had been with the cement plant only 8 and 10 years respectively and showed dust deposits in lungs, had been previously employed for a long time in a cigar factory. The X-ray of a 21-year old worker employed in the packing room for only 5 years showed some changes indicating dust collected in lungs.

Years of Work	Crushers	Mill	Kiln Room	Cement Mill	Packing Room	Others	Total
1-9	—	1	1	—	—	—	2
10-19	—	—	1	2	—	—	3
20-29	1	1	4	1	1	—	8
30-39	—	—	4	—	2	1	7
40-49	1	—	—	—	—	—	1
	2	2	10	3	3	1	21

Considering the number of cases of dust deposits in lungs grouped according to the different sections of the plant, it appears that most of these cases are met with in the kiln room. However, this statement should be qualified. First of all, an exceptionally large number of old men was selected from this section and second, a great many of these had previously worked in the raw mix silos. Nevertheless, it is not unlikely that the clinker dust, whose hard, fine and hardly visible particles form a coating on the eye after years of work, has also a special effect on the lungs. It is also possible that the temperature of warm and hot dust may be of some influence. The occurrence of dust in the lungs is less frequent and more uniformly distributed throughout the other sections of the plant. In general, only the younger men were selected in the packing room; no dust deposits were discovered in the lungs.

The preceding table gives the distribution of dust-encumbered lungs in the different sections of the plant.

Tuberculosis

In order to understand the relation between dust-impregnated lungs and tuberculosis, one must know that, according to the present-day conception, a good majority of all human beings are infected with the tuberculosis bacillus from early childhood on and that about 96 per cent of all individuals undergo such an infection before they begin to work. When tuberculosis bacilli penetrates to the lungs through the bronchial tubes a focus of the disease is formed, the so-called primary effect, which may be detected by X-ray after many years and in which living bacilli may be found after an equally long period. If afforded an opportunity, further infection may spread through the lung from this old germ center until tubercular lung conditions are produced. Such is the usual process; for, according to recent investigations, an infection due to environment at later dates (Exogene Reinfektion) is seldom encountered in adults. The question of whether we deal with cases of incipient tuberculosis placed in a dusty atmosphere or whether the infection is produced by the dusty atmosphere is of utmost importance in determining the relation between dust-impregnated lungs (Staublunge) and tuberculosis. We are inclined to agree with the former view.

Be it as it may, the observations recorded point out that inhaling of lime and cement dust shows no tendency to produce tuberculosis. On the contrary, one gains the impression that they have a desirable effect on the progress of tuberculosis.

To return to the material at hand, 3 men who had undergone a sanitarium cure, showed no signs of past or existing tuberculosis. Even had the original diagnosis been erroneous, such signs would have been in order and quite characteristic.

In twelve cases, the germ focus cured in childhood was established with certainty in carriers who had no knowledge of their condition. In nine cases, changes were found whose location and nature were typical of healed, one or two-sided (Schrumpfende) tuberculosis of the upper lungs. With the exception of one man who had hemorrhages 18 years before, but was completely cured and capable of work, no one among the workmen investigated had any consciousness of his trouble. No consumptive, nor incapacitated men were listed.

Some Specific Cases

Two men, 54 and 58 years of age, employed in the kiln and grinder rooms respectively, showed pronounced extensive changes. The location and the nature of the shadows of spots and of the dark areas on the X-ray photograph permitted to conclude a complication with tuberculosis, though no tuberculosis bacilli were found. Judging by the similarity to other cases, we were unquestionably dealing here with a mild form of tuberculosis (no expectoration or fever). The blood test was also doubtful, contrary to the majority of observations. No pain nor physical changes were apparent. Ickert and Hubschmann have described similar impregnation of lungs and have proven that they were related to tuberculosis and that the tuberculosis bacillus in a lung loaded with dust produced an extremely strong increase of the binding tissue (Bindegewebe) and thus created this pronounced image of "Pneumokoniose" (dust impregnation of lungs).

An unusual phenomenon was noted in two cases. The X-ray of a 50-year old man from the kiln room showed on the outer edge of the right lung a homogeneous sharply outlined shadow having an upward trend and connected with a nearly horizontal almost motionless diaphragm in the picture. We deal here with a harmless line impregnation as a result of a healed inflammation.

Our observations agree with the evidence of therapeutical experiments with lime and silica inhalations by tuberculosis cases.

Rosenfeld shows by experimental evidence that the calcium content of tubercular lungs is 25 per cent lower than that of normal lungs. Kahle found that acute tuberculosis reduced the silicic acid in the bladder and in the abdominal glands of his patient. He, therefore, concluded that a tuberculosis patient is the more powerless to combat his ailment the less silicic acid is present in the organs. Rossle decidedly maintains that inhaling lime and silica has a preventive and curative action. In doing so he not only has reference to their mechanical action, but speaks of silica as a "non-specific preventative substance" which heals the tuberculosis process.

On the basis of these considerations (according to Reckzeh) Kuhn prescribed a special powder for tuberculosis patients made up of 70 per cent lime, 10 per cent silica, 15 per cent coal and 5 per cent iron oxide and alumina, letting them inhale it, and is still following out this idea in practice.

Conclusions

Summing up the above: *even decades spent in cement plants bring about no lung trouble harmful to human life. At most a catarrhal condition is produced with a tendency to lung expansion or to dust impregnation of lungs detectable by X-ray without impairing the working ability, the length of life nor of the working period.* It is not clear whether lung expansion in cement workers develops in the same manner as in those employed on other hard physical work; nor is the part played by various contributing factors, when dust is present in the lungs clearly defined. However, their action is probable, because lung changes need not appear even in the case of old workmen (for instance, one with 15 years in sandstone quarry and 25 years in cement plant shows no dust impregnation). The greater tendency to dust impregnation of lungs in the kiln room is perhaps due to clinker dust, that is, to its hardness and temperature. *We can state with certainty that employment in cement plants does not in itself carry any danger of tubercular trouble. On the contrary, tuberculosis shows a satisfactory course in cement plants.*

Storage of High Explosives

Recommendations as to the Location and Construction of Magazines for the Storage of Dynamite, Permissible Explosives and Blasting Accessories

By C. H. COALE

For a good many years the matter of proper storage for high explosives has been given careful thought by explosives manufacturers. Today all the larger manufacturers employ trained men who give their entire time to the locating and building of magazines and every detail in the construction of the present approved type of magazine is based on tested experience. While it is not the intent to pass the entire burden of explosives failures to the jobbers, dealers and consumers, it is a truth that when defective explosives are found in the field, the cause of deterioration can usually be traced to improper storage. This is probably brought about by the fact that purchasers of explosives are not always familiar with what is desirable in magazine construction.

Two of the chief causes for the deterioration of explosives are moisture and changes of temperature. While all high explosives are more or less susceptible to one or the other of these influences, the ammonia types—and these include most of the present day permissibles—are more susceptible to both of them than are the nitroglycerin and gelatin types. Nitrate of ammonia absorbs moisture readily and becomes less sensitive when damp. If subjected to a high temperature for some length of time nitrate of ammonia may undergo a change in crystallization which will cause cartridges containing it to become so hard that they will be difficult to prime and difficult to detonate. Consequently, while magazines of approved construction are needed for all types of explosives, it may be expected that the ammonia explosives will deteriorate in improper storage more quickly than will other types.

Since moisture and changes of temperature are the two principal causes of deterioration in explosives, magazines should be especially constructed to protect explosives from exposure to these conditions. Three types of magazines are today approved by explosives companies: brick magazines, sand filled magazines and portable iron magazines.

Concrete is not recommended for magazines because of the possibility of flying missiles in the event of an explosion. Likewise common soft brick is recommended instead of hard burnt brick because it is less likely to give flying missiles.

While brick magazines are ordinarily to be preferred for permanent storage, sand filled magazines are also satisfactory and are cheaper to build in some localities. The construction consists, in brief, of a wooden frame sheathed inside and outside, with the space between the studs filled with dry, coarse sand and with the outside walls entirely covered with iron. Gravel and broken stone are not recommended for filling because they are likely to fly and do damage should there be an explosion in the magazine.

Portable iron magazines will serve in moderate climates but they are not advised for use in warm climates. In case such a magazine is exposed to the direct rays of the sun, it is good practice to build a false timber roof over the iron roof or to put up a ceiling inside, in order to maintain as even a temperature as possible within the magazine.

Magazines should not rest upon the ground but should be high enough above it to prevent the explosives from absorbing dampness from the ground and to allow free circulation of air beneath the floor. Foundations of a magazine for permanent storage should be of concrete, stone or brick. If the magazine is only for temporary storage, foundations may consist of wooden posts. In this case, the space from the floor of the magazine to the ground should be sheathed and covered with galvanized iron. The chief means of keeping a magazine dry and of uniform temperature is to provide proper and sufficient ventilation. It is bad practice to build magazines with dirt, brick or concrete floors and with foundations without openings in them. The floor should be of board with not less than a two-inch space between it and the walls. There should also be openings in the foundations and a metal ventilator in the roof. If the magazine is constructed with a ceiling there should also be a two-inch space between it and the walls so that there can be a free circulation of air through the magazine from foundation openings to roof ventilator at all times. All ventilation openings should be protected by screens.

As a safety measure it is important that magazines be proof against the ordinary rifle bullet. The walls of a brick or a sand filled magazine are usually sufficient in themselves for bullet-proofing. Portable iron magazines can be made bullet-proof by lining them with brick or hardwood plank or by putting up studs and a tongue and groove lining and filling the space between it and the iron walls with sand. Doors for magazines should be of steel plate with a wood backing of sufficient thickness to prevent penetration by bullets. If the magazine is so located that it can be shot into through the roof it is advisable to build an inside ceiling and cover this with sand deep enough for bullet-proofing.

Other materials such as blasting caps and electric blasting caps, paints, oils and carbide should not be stored in the same building with high explosives. A separate magazine should be provided for blasting accessories. Such a magazine should be weatherproof and fireproof. Any one of the types of magazine described for storage of high explosives would be suitable for the storage of blasting accessories, or, for small quantities, a portable box magazine constructed so as to be weatherproof and fireproof is satisfactory. A blasting accessories magazine should be at least 100 ft. distant from a high explosives magazine. All magazines should be equipped with strong, substantial locks and kept locked.

As almost high explosives now made by the larger manufacturers are low freezing it is no longer necessary in the construction of storage magazines to provide any special means for the prevention of freezing.

The consideration of primary importance in selecting a site for a magazine is that of safety. The magazine should be so located that in case of an explosion no serious damage will be done to persons or property. The distance that a magazine should be from buildings, highways and railroads to secure safety depends upon whether it is protected or unprotected.

In some states there are state laws and in most cities there are ordinances governing the storage of explosives. These laws and regulations should be investigated and complied with by consumers desiring to build magazines. In states where no such laws exist, it is recommended that explosives magazines be located in compliance with the American Table of Distances. Some excerpts from this table are printed herewith:

Quantity of explosives to be stored	Inhabited buildings barricaded* feet	Public railways barricaded* feet	Public highways barricaded* feet
From 100 to 200 lbs.	180	110	55
From 500 to 600 lbs.	400	240	120
From 1,000 to 1,500 lbs.	530	320	160
From 1,500 to 2,000 lbs.	600	360	180
From 5,000 to 6,000 lbs.	780	470	235
From 10,000 to 15,000 lbs.	890	535	265
From 20,000 to 25,000 lbs.	1055	635	315
From 40,000 to 45,000 lbs.	1340	805	400

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*Barricaded, as here used, signifies that the building containing explosives is screened from other buildings, railways, or from public highways by either natural or artificial barriers. Where barriers do not exist the distance should be doubled.

As stated before, protection may consist either of natural barriers such as hills or woods, or of artificial barricades. Natural protection is preferable, of course, and to obtain this it is often necessary to build on the side of a hill. In such case, the proper provision should be made for carrying off rain water and melting snow by means of roof gutters on the magazine and ditches around it. Indeed adequate surface drainage should always be provided in the immediate vicinity of a magazine whether located on a hillside or elsewhere. The ground around the magazine should also be kept clean and free from falling leaves or dry grass as these increase the fire hazard.

Cement Plant Accidents Cut 45% Since 1920

What accident prevention experts believe is a record in the reduction of industrial accidents was announced the other day by William M. Kinney, general manager of the Portland Cement Association, with the statement that since 1920 the "safety first" activities carried on by his organization have reduced the number of accidents in portland cement mills 45.2 per cent, the number of days lost due to accidents 40 per cent, and the number of fatalities 33.3 per cent.

Mr. Kinney explained that the records apply to the whole industry, which employs more than 40,000 workers. Individual plants far exceeded these figures, however. Plant No. 8 of the Canada Cement Company at Port Colborne, Ontario, and the Duluth, Minnesota, plant of the Universal Portland Cement Company, each ran practically a year and a half without a single lost-time accident. Two men from each of these plants will be sent to the spring meeting of the Association in New York City to receive the Portland Cement Association's safety trophy.

When members began this safety work thirteen years ago they found to their surprise that the responsibility for accidents lay about 25 per cent with the manufacturers, and about 75 per cent with the men themselves. In many plants, investigators learned, the machinery itself was dangerous. But the men themselves, either through ignorance or recklessness, were far more dangerous.

Members were quickly induced to protect their machinery, and then an intensive campaign was begun among the workers. The cement makers undertook all this work with the idea that they were simply spending money for their employees, but they quickly found that it paid them in actual dollars and cents, through improvement of their manufacturing personnel, reduction in delays and saving in accident compensation. Hence they have continued it enthusiastically.

The Cost of Low Power Factor

Part II

A Discussion of Power Factor in Cement Mill Power Transmission Systems from a Dollars and Cents Basis

By C. H. SONNTAG

This is Part 2 of an article dealing with the fundamental side of questions relative to low power factor and its cost. Part 1, which appeared in the May, 1926, issue of the Cement Mill Section of CONCRETE, cited the example of an actual contract for a small power supply to an ice plant, and pointed out that a utility company furnishing a large block of power such as needed to operate an entire cement mill, will have the matter of power factor in mind in making the price it offers. The wisdom of those contemplating the purchase of power of ascertaining what reduction in its cost may be obtained by insuring that the load shall always be at high power factor when near its maximum demand is emphasized.

(b) The Cost or Capacity of Generators

The generators, either engine or turbine driven, that were sold twelve or fifteen years ago were, from the modern standpoint, very liberally rated. Operators have frequently wished that such machines were standard today. They were nominally rated for a certain output in KW. at unity power factor, but they were usually able to carry this same load at power factors of 80 or even 75 per cent. This permitted the prime mover, engine or turbine, to be worked up to its full normal capacity without much regard to the heating of the generator.

Such machines can no longer be had except in the used equipment market. Those sold today are rated on the KVA. basis, or what amounts to the same thing, on the KW. basis with a specified minimum power factor, usually 80 per cent. They have little or no overload capacity, and it is up to the operator to get the most out of them by keeping the power factor high. In turbine driven sets the safety of the generator is to a certain extent insured by adjusting the turbine so that it can not supply enough power to materially overload the electrical end.

The load that a generator will carry is limited by the rise in temperature in it caused by the passage of the current through it. For a three phase machine equation 6, repeated here, shows that the power generated will be

$$W = V \times A \times 1.73 \times p$$

If the power factor is 80 per cent, it is evident that when the machine is at its maximum safe temperature and when the current in amperes is at its highest safe value the useful work is only 80 per cent of what it would be if the power factor were unity.

To use specific figures, a certain generator will carry continuously, with a temperature rise of 55 deg. C., a three phase load of 4511 amperes at 480 volts and .8 power factor. Equation 6 shows that the actual energy sent out on the line is

$480 \times 4511 \times 1.73 \times .8 = 3{,}000{,}000$ watts or 3000 KW. Now if the power factor were raised to unity this expression would be

$480 \times 4511 \times 1.73 \times 1.0 = 3{,}750{,}000$ watts or 3750 KW., which means that a generator that at 80 per cent power factor will produce only 3000 KW. will, when the power factor is unity, turn out 3750 KW., which is an increase of 25 per cent with no change whatever in the machine itself, and with no increase in the temperature rise.

A turbo-generator set is always sold as a complete unit, so that it is difficult to set a price for the electrical end only. If we assume it to be $6 per KVA., in the case of the above machine, a 3750 KVA. generator would be bought, which would cost $22,500. If 3000 true KW. capacity were all that were needed, and the power factor could be made 100 per cent at full load, a 3000 KVA. generator would have been large enough, and would have cost $18,000. The difference in price is $4500, and this with the 15 per cent carrying charge of $675 per annum is the penalty paid for operation at 80 per cent power factor, and it should be remembered that in mills where no attempt at correction is made this figure is apt to be 75 per cent or less.

Without reproducing the calculation here it may be shown that if 1125 KW. of the 3000 KW. 80 per cent power factor load is removed (assuming all motors to have the same power factor), there can be added 1875 KW. load in synchronous motors or other devices at 80 per cent leading power factor, and the result will be a load on the generator of 3750 KW. at 100 per cent power factor, which it can handle. (The efficiency of the various machines is not taken into consideration here, but if it were it would not greatly alter the conclusions.)

Now it is true that if this change is made by replacing medium speed induction motors by slow speed synchronous ones the difference in cost per horsepower will offset some of the saving in generator investment. We must remember, however, that power factor correction is only one of the reasons for the use of slow speed synchronous machines. Others are the elimination of belts, saving in space by direct connection, as to tube mills, and the use of the flywheel effect of the rotor, as in air compressors, so that all the cost of making the change should not be charged against power factor correction.

As previously stated, in a modern turbo set the turbine is usually so designed that it can develop power only up to the rating of the generator in kilowatts, but can not seriously overload it. The steam end of a set rated at 3000 KW. at 80 per cent power factor will give only 3000 KW. at the shaft, and it may be contended that there is no use in bettering the power factor and increasing the capacity of the generator to do work if the turbine is not able to drive it at that rate. If the purchase of a new turbo set is in hand it would be proper to specify, using the previous figures as examples, a turbine that will deliver 3750 KW. at the shaft, but if it is a question of getting more power out of equipment already installed, the case is different if the machines are reasonably new and rated according to modern standards. In some turbines the horsepower capacity may be raised 25 per cent by slight changes in the angles of the blading, whereby the area of the steam passages is increased. This involves a sacrifice of about .4 pound per KW. hr. in the steam rate—that is to say, a 3000 KW. machine using 15.5 pounds of steam per KW. hr. would become a 3750 KW. unit at 15.9 pounds per KW. hr. This is an increase in steam consumption per KW. hr. of about 2.6 per cent, which in most cases would not be considered serious, especially where all or a large part of the steam comes from waste heat boilers. It is not intended to say that such a change can be made in every turbine, and those contemplating it should take the matter up with the builders, but there is the possibility of increasing the capacity of many turbo sets now in use by substituting synchronous motors for the induction type, and at a trivial increase in the steam used per KW. hr. Provision would also have to be made to circulate more water through the condenser to take care of the additional steam, and the air pump would be worked a little harder.

To use specific figures, suppose that a 3000 KW., 80 per cent power factor power house costs, exclusive of boilers, $175,000. The same equipment, except for the changes that may be necessary in the condenser, will develop 3750 KW. at 100 per cent power factor. Even the switchboard and cables will show no distress, for they will be called upon to carry no larger current in amperes than before.

The annual carrying charges against this, at 15 per cent, will be $26,250. If 21,600,000 KW. hr. are generated in a year the overhead per KW. hr. is .122 cent.

Now if this same installation has its full load rating changed to 3750 KW. by raising the power factor to 100 per cent, and turns out in a year the same percentage of full load rating as before, it will generate 27,000,000 KW. hr., and the annual overhead per KW. hr. will be .097 cent, which is .25 cent less than before. The extra output should be obtained with no increase in the engine room labor. If the mill is using 15 KW. hr. per barrel there will be a saving of 15 × .025 cent = .375 cent per barrel.

This may seem too insignificant a reduction to be worth striving for, but if the additional power made available is used to effect a proportionate increase in production, many other costs will come down also because of the increase in the divisor. The individual reductions will be small, but their total will be a very worth-while figure.

The boilers have not been considered in the foregoing because circumstances as regards them vary so greatly. If all steam is made by direct firing, the extra output needed can probably be obtained by forcing the boilers already in use, supplying artificial draft if necessary. If waste heat boilers are furnishing all or part of the steam, direct firing of other boilers is likely to be required unless the kilns can be forced to increased steam and clinker production.

(c) The Cost and Capacity of Transmission Lines

In carrying heavy alternating currents over large conductors the power lost in heating the conductor is not negligible. As in any other electrical heating device, the energy dissipated is proportional to the square of the current in amperes. But the current is inversely proportional to the power factor, whence it follows that the power loss is inversely proportional to the square of the power factor. To put it in figures, the loss in a line carrying a load of a given number of kilowatts at 75 per cent power factor, not uncommon in cement mills, will be

$$\frac{1}{(.75)}2 = \frac{1}{.5625} = 1.78,$$

or nearly twice what it would be at 100 per cent power factor.

The cost of a transmission line such as is used in a cement mill is proportional to the weight of copper in it. The size of such a line is commonly calculated on the understanding that a certain small percentage of the power entering it will be used up in overcoming the resistance of the conductor. The energy loss is, as we have just seen, inversely proportional to the square of the power factor. If we wish to keep the loss in kilowatts at a constant figure while using a variable power factor, it will be necessary to vary the cross-section, and hence the weight, of the cable in the inverse ratio to the square of the power factor.

This will be made plainer by the following example, taken from the writer's experience:

It is desired to transmit 1680 KW. in three phase 60 cycle current, with a voltage of 440 at the load end, and with a power factor of 80 per cent, the distance being 650 feet, the power loss being 2 per cent, and the cables being carried in racks with 4 inches between centers of cables.

Calculation shows that the cross-section of each conductor should be 4,570,000 circular mils (c.m.), and in practice three 1,500,000 c.m. cables in parallel would be used. The nine conductors would weigh 27,000 lbs. and the current per phase would be 2760 amperes.

Suppose the power factor to be 100 per cent. With the same loss in the line in kilowatts the cross-section per phase would be only 2,930,000 c.m., which in practice would be made up of two 1,500,000 c.m. cables in parallel.

We have saved one-third the weight of copper, or 9000 lbs., which at 13 cents per pound amounts to $1170, which could be applied as part of the cost of power factor correction equipment. Costs of additional insulating supports and of installation labor have not been considered, though they are important items when placing such heavy cables.

(d) The Cost of Capacity of Transformers

The builders of transformers rate them in kilovolt-amperes (KVA.), which is equivalent to saying that they will pass a certain current with a given voltage across the terminals without overheating. Using specific figures, a single phase transformer passing 200 amperes at 2200 volts terminal pressure will carry a load of

2200 × 200 = 440,000 volt-amperes = 440 KVA.

If the load is at unity power factor this will represent 440 true kilowatts (KW.) available for useful work. But if the load have a power factor of only 75 per cent (a not uncommon figure), the available energy that can be drawn through this transformer will be only 440 × .75 = 330 KW. Then if we must actually have 440 KW., the transformer must be rated at 440 ÷ 75 = 587 KVA.

Now if transformers cost $3 per KVA., we have as first cost in this case

For 100% power factor, $3 × 440 = $1320.
For 75% power factor, $3 × 587 = $1761.

The difference is $441, which is the penalty paid in added investment for the low power factor. In addition, there would be an annual carrying charge of about 15 per cent of this amount, or $66.15.

If the same total energy is distributed through several smaller transformers, the increased investment consequent on the low power factor will be considerably greater, for the first cost of a KVA. of transformer capacity rises rapidly as one goes into the smaller sizes.

(To be concluded in July issue)

Consolidated Cement Corporation Formed by Merger

The Consolidated Cement Corporation was recently formed under the laws of Delaware for the purpose of owning and operating the plants of the Peninsular Portland Cement Co., Cement City, Mich., the Fredonia Portland Cement Co., Fredonia, Kansas, and the Great Western Portland Cement Co., Mildred, Kansas. While each plant retains all of the advantages of local operation and of a complete local organization the corporation will be under the direct supervision of the Cowham Engineering Co., the well-known engineering and management company specializing exclusively in cement plants. John L. Senior, president of the Cowham Engineering Co., is president of the Consolidated Cement Corporation.

The combined output for the plants included in the merger was, in 1924, 2,157,696 bbls., and the combined output in 1925 was in excess of 2,566,000 bbls. With the addition of new kilns and other equipment now installed the combined capacity of the three plants is estimated to be in excess of 3,000,000 bbls. per annum. It is reported that the raw material deposits of these properties are more than sufficient to meet requirements of the plants for the next 50 years.

The following information relative to the three plants is given by Mr. Senior:

The Peninsular plant located at Cement City, Michigan, a suburb of Jackson, has been in operation since 1901. Equipped to operate on either limestone or marl, the Peninsular plant is fortunate in being situated close to large deposits of marl and clay. It is located in the south central part of Michigan, on the New York Central R. R. running between New York and Chicago, and has adequate rail facilities for making prompt and direct shipments. Most of the cement produced by this plant is sold in Michigan, Ohio and Indiana, the former state taking practically two-thirds of the output.

The Fredonia plant located at Fredonia, Kansas, about 125 miles southwest of Kansas City, has been in operation since 1907 as the Fredonia Portland Cement Co. This plant maintains its own power producing station, employing both natural gas and oil as fuel for its prime movers, as well as for firing the kilns. The close proximity of this plant to the field producing natural gas and oil obtains for it a very advantageous rate for fuel. The company owns all of its principal raw materials supply, including 200 acres of limestone. Suitable clay is in abundance and gypsum is shipped in from Oklahoma. Three railroads assure the Fredonia plant adequate car supply and shipping facilities. The principal markets for the output of this plant are Western Missouri, Kansas, Nebraska and parts of Oklahoma and Arkansas.

The Great Western plant located at Mildred, Kansas, is the nearest plant to Kansas City of any of the so-called Kansas gas belt plants and has been in operation since 1908. The Great Western Portland Cement Co. was organized in 1922 to take over this plant from the Great Western Portland Cement Co. (of Kansas), and has since marketed its product under the brand "Victor." This plant owns its limestone and clay and shale deposits, and the occurrence of these deposits is especially favorable to the cheap production of the raw material. Located in eastern Kansas on the main line of the Missouri, Kansas & Texas Ry. between Kansas City and Dallas, it is favorably situated for distribution of its product to and through Kansas City. The Great Western plant has great advantages for shipping cement to points in Kansas, Missouri, Arkansas, Oklahoma and parts of Iowa, Louisiana and Texas.

State Cement Plant Figures Interesting

Under the heading "Prison Labor Seen as Loss," the *Detroit Free Press* recently published an Associated Press article quoting the *Adrian Telegram* regarding the results of an investigation of the Michigan State cement plant at Chelsea, Mich. It is stated that state officials made available all books and records relating to the purchase and operation of the property, and that Kennedy Potter of Jackson gave access to the corporation reports of the company under private ownership.

As it has been previously pointed out, deductions by the press are in many instances practically the only sources of information available to the public in general relative to the operation of the state cement plant. The following is quoted from the above mentioned article:

"An investment of about $1,127,000 appears to have been made by the state in the business to date, of which $827,000 or thereabouts has been paid over. Under its purchase contract the state will pay $500,000 for the property as it stood when it was leased in 1923, of which $200,000 has been paid. New buildings, equipment and machinery have cost $192,251 and working capital of $435,000 has been furnished.

Food, Clothes Not Listed

"Net profits were figured to be $149,785 in 1924 and $114,627 in 1925 from gross or mill earnings of $300,391 and $222,174, respectively. No charges are carried against the business for the food and clothing of the prison inmates employed, but the cost of more than $40,000 each year for guards and institutional employes is deducted. Food and clothing of inmates is estimated to have cost about $42,705 for each of the two years, and with this item deducted the net profits would be reduced to $107,080 for 1924 and $71,922 for 1925.

"No depreciation fund is carried such as was maintained under private management, but extensive repairs and replacements have been paid for as operating charges. Repairs and replacements amounted to $62,159 in 1924 and $56,298 in 1925.

Failure Until 1919

"Books and official statements of the company as far back as 1912 indicate that up to 1919 the plant was a failure, a 'dud.' But in 1919 the plant was converted to use lime rock instead of marl for its raw material. Impressive gross profits are shown for the years 1921-23 preceding the sale to the state. The corporation reports for these same three years show that the gross or plant profits were reduced by big deduction charges when they underwent final treatment.

"In 1921, with $172,268 gross profit, the net corporation earning as finally figured was $5,482. In 1922 the gross earnings were $171,000 and the corporation deductions wiped them out completely and showed a net loss of $15,867 for the year. In 1923 the gross earnings were $287,194 and the net was figured at $56,211.

"Kennedy Potter says the company had years of losses behind it, years when corporation charges against the gross earnings couldn't be made and that the corporation frankly was trying to recuperate from these years.

Cost Boosted, Claim

"Prison inmate labor has not effected any saving in production costs during the two years of state operation. In 1923 it cost the Potters 33 cents in wages to free laborers for every barrel of cement produced. In 1924 the state paid 30 cents a barrel, and in 1925, 34 cents a barrel in wages to free laborers and convicts and in charges for guards and watchmen to look after the inmates. These charges do not include food and clothing for the 100 prison inmates carried on work roster at the plant. If the maintenance costs were included, they would add from 7 to 9 cents a barrel to the labor item and make the prison inmate system appear actually to have lost the state money.

"State officials, however, argue that food and clothing is not a legitimate charge against the plant, as the prisoners must be maintained somewhere, and the overcrowded condition of state institutions makes it imperative that relief be afforded by such diversion."

Cement Production Shows Increase for March

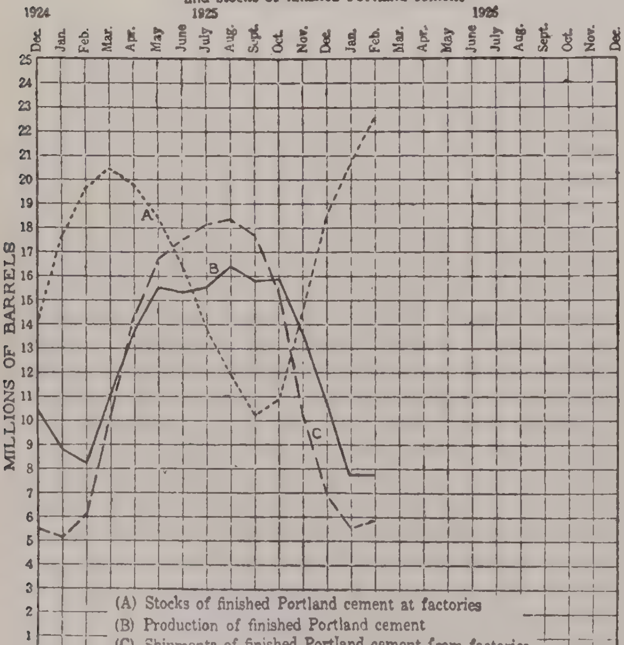
Production of portland cement in the United States for the month of March, 1926, amounted to 10,323,000 bbls. as compared with 11,034,000 bbl. for the same month in 1925, according to the Department of Commerce, Bureau of Mines, Washington, D. C. Shipments during March, 1926, totaled 9,499,000 bbls. as compared with 10,279,000 bbls. in the corresponding month last year, and stocks at the end of the month were 23,212,000 bbls. as compared with 20,469,000 bbls. at the end of March one year ago.

The clinker (unground cement) at the mills at the end of March is estimated at 12,277,000 bbls., and at the end of March last year the clinker was 9,962,000 bbls.

Import and export figures for the month of March are not available. For the month of February, 1926, exports reported by the Bureau of Foreign and Domestic Commerce, amounted to 73,975 bbls. valued at $220,706. Of this amount 37,391 bbls. valued at $114,391 went to South America. The next largest amount exported was to Cuba, being 13,072 bbls. valued at $31,105.

The grand total of imports for February of this year was 314,118 bbls. valued at $527,948. Belgium imported 214,933 bbls. valued at $344,205 into Florida, Massachusetts, New Orleans and San Francisco districts. Of this amount, 176,865 bbls. of Belgian cement entered the Florida district.

Monthly fluctuations in production, shipments, and stocks of finished Portland cement



During February, 1926, 386 bbls. of domestic cement was shipped to Alaska, 12,452 bbls. to Hawaii and 3,116 bbls. to Porto Rico. The total value of these shipments was $35,689.

Rockland Soon to Have Large Cement Plant

Work will be started in the near future on the construction of the 1,500,000-barrel Portland Cement Plant to be designed and built by the Cowham Engineering Co., at Rockland, Me. Preliminary surveys are now under way and the design of the plant will be started within the next few days.

In general the layout of the plant will be similar to that developed by the Cowham Engineering Co. and first applied to the plant of the Signal Mountain Portland Cement Co.

The main feature of this layout is the elimination of unnecessary handling of the raw materials and finished product, accomplished by the use of the wet process of manufacture and the utilization of a central storage building for raw materials and fuel. This one building for a plant of the size of that to be built at Rockland will be between 800 and 1,000 feet long.

The principal mechanical features of the plan will consist of three kilns of a daily capacity of 1,500 barrels each. These kilns will be of the size standardized by the Cowham Engineering Co., 11x175 feet. Early proposals call for a finish cement storage of 100,000 bbl. The plant will be located so as to be able to load direct into boats for ocean going shipping. The plant when completed will employ between 250 and 300 men.

In all probability the raw materials will be transported to the plant by the Lime Rock Railroad Co. Although the Rockland & Rockport Lime Corp. will not be directly interested in the cement company, a close affiliation will be maintained through the Lime Rock Railroad Co. and the Rockland Transportation Co., which it is contemplated will carry a large part of the plant's output to nearby ports.

Central States Portland Cement Company to Build

Announcement has recently been made through the office of the Cowham Engineering Co., 111 West Monroe street, Chicago, of the organization of the Central States Portland Cement Co., to build a $3,000,000 Portland cement plant at La Salle, Ill. This plant will make available to the Chicago market approximately 1,000,000 bbl. of Portland cement per year.

The site selected for the plant of the Central States Portland Cement Co. is directly east of La Salle where the company has acquired approximately 170 acres of limestone and clay lands for the supply of the raw materials. The plant will utilize the wet process of manufacture and will employ about 250 people.

The original plans call for the erection of a large storage building for raw materials and silos for cement storage for a capacity of 100,000 bbl.

Mr. John L. Senior will be president of the Central States Portland Cement Co. and Mr. Fritz Worm of La Salle, Mr. R. A. Drum of Chicago and Mr. H. J. Weeks of Chattanooga, Tenn., vice presidents.

Slurry Spray Increases Rotary Kiln Efficiency

By A. C. BLACKALL
London, England

Notwithstanding its obvious advantages and its great saving in manual labor, the rotary kiln as used in the production of portland cement possesses a number of serious drawbacks. It is generally admitted to be exceedingly wasteful of fuel. Many attempts have been made in the past to remedy these defects, but so far without any very great success, although the substitution of fan draught for the tall chimney stacks and the gradual increase in the length of the kiln have undoubtedly been steps in the right direction.

A trouble encountered in using this kiln, which has hitherto baffled all attempts at its solution, is the tendency to the formation of the so-called "slurry rings" near the cool end of the kiln. With certain descriptions of slurry, such as those composed of chalk and clay, these aggregates of slurry are more frequent and more troublesome than in the Lias areas, and it seems apparent that their appearance largely depends not only upon the degree of moisture in the slurry, but also on the nature of its constituents, some types of slurry being far more viscous than others.

A slurry ring in the course of formation gives rise to great loss of heat owing to the construction of the kiln section, and the stoppage of work entailed by its removal involves serious loss of time and consequent reduction in output.

Slurry rings, which have been described as the worst enemies of the burner in rotary kiln practice, are caused mainly by the present system of feed, in accordance with which the liquid mixture is poured in a continuous stream upon the wall of the kiln and is spread over the heated kiln-lining by causing the kiln to revolve slowly on its own axis. Numerous devices have been tried from time to time for the prevention of slurry rings, such as scrapers, chains and the attachment of "lifters" to the walls of the kiln. These lifters carried the liquid slurry up to the top of the cylinder and discharged their contents automatically in consequence of the rotation.

In utilizing the rotary kiln for the wet process of manufacture, two entirely different operations have to be carried out. Firstly, the water, which usually ranges from 38 to 42%, has to be removed as rapidly as possible, and subsequently the carbonic acid gas in the hot zone has to be expelled, after which the clinker is formed by the incipient vitrification of the mass.

In order to keep the kiln walls sufficiently hot to expel by evaporation the water used in making the slurry mixture, it is found necessary to maintain the exit gases at a high temperature, approaching 400 degrees C. This entails much loss of heat up the stack. If the temperature is excessive, however, numerous particles become dried and are carried out of the kiln altogether as dry dust. The caking of the slurry on the kiln walls is undoubtedly due to an excess of moisture at the time of its deposit, and as the coating increases in thickness the temperature of the lining is steadily reduced and a hindrance is created to the proper and efficient operation of the kiln.

Atomizing Slurry Feed

Such, briefly, are the imperfections of the existing method of working. This introduction makes it possible to describe in the minimum of words the alterations brought out by a new plan patented by Thomas Rigby, of introducing the slurry into the kiln in the form of a very fine spray by the use of atomizing jets. By the means of Mr. Rigby's process the whole of the first 20 to 25 feet of the length of the cool end of the kiln is filled with the slurry in an exceedingly fine state of subdivision, and by the adoption of different pressures in the spray producers two or more zones of spray are formed, extending over the entire area of section. Consequently, the heated gases are employed to the best advantage in expelling the water, and before the sprayed particles have time to settle they are deprived of their inherent plasticity, which possibly gives them the tendency to become agglomerated into masses of considerable size. The exit gases are reduced to about 135 degrees C., and a far more effectual use of the fuel is achieved. The pellets of dried slurry are smaller than those formed by the old method, and when driven forward by the rotation of the kiln into the hot zone they tend to form a better and more uniformly vitrified clinker. In the great majority of rotary kilns at present in use in the United Kingdom an excessive amount of space is devoted to drying the slurry, and the clinkering operation at the hot end of the kiln does not extend sufficiently far to ensure that the full value of the fuel is utilized in this part of the process.

By the adoption of the spraying system the hot zone is extended much farther up the kiln, and in consequence a larger bulk of the slurry can be clinkered in a given time. The process, which has now been in use for some months at Harbury, England, at the works of Greaves, Bull, & Lakin, thus leads to an increase in output, which is claimed to amount to from 30 to 35 per cent of clinker. In other words, in a kiln 8 feet in diameter and 160 feet in total length the yield is nearly one-third more under the spraying system than by the "pouring" process, and without any appreciable increase in the quantity of fuel consumed.

A series of meetings held throughout the country during April, having for their purpose the focusing of attention on the part of physicists, chemists, engineers, operating men, and the industries, on the recent progress and the immediate possibilities in the utilization of oil and gas for power purposes, resulted in many papers of interest. These meetings were sponsored by many organizations of an industrial and governmental nature, and were guided by a steering committee who aided the organization of the local meetings on the basis of constituting an Oil and Gas Power National Conference. A cash prize of $100 has been offered for the best paper brought out.

A new concern under the name of J. B. Broutin has been organized with offices and plant at 17, rue de L'Ourcq, Paris, for the purpose of manufacturing and selling special cements, colored mortars and all similar products, notably those known as "cimental" and "stucaline." The capital is 600,000 francs in shares of 500 francs of which 800 shares revert to Jean-Baptiste Broutin as promoter.

the substitution of a synchronous for an induction motor, the power factor is raised to unity, the transformer will be able to carry a useful load of 587 KW. Hence it is seen to be generally true that improving the power factor of the load of a transformer automatically raises, in the same ratio, the amount of real power that it will handle.

For the sake of simplicity, the figures just presented have been based on the use of a single phase transformer. They will not be greatly different if one three phase unit is considered, but if the 440 KW. is to be carried by three single phase transformers the penalty for low power factor will be greater, because the smaller units will cost more per KVA.

(e) Voltage Drop at the Ends of Lines

In a direct current system the drop in voltage from the generating to the distant end of a line is directly proportional to the power loss. In an alternating current circuit the relations are not so simple, and the loss in voltage may be considered to be made up of two parts:

(1) The resistance drop, which depends on the number of amperes flowing and the material of which the conductor is made, is similar to the drop in a direct current circuit.

(2) The reactance drop, which depends on the size of the current in amperes, the number of alternations per second and the distance between the conductors of the circuit. It is less the closer the wires are together, and is the result of the rapidly alternating magnetic field built up around the conductor. It does not represent a loss of energy.

The total drop in the line is not the arithmetical sum of the resistance and reactance drops. The relations between them are not simple, and the total is best found from charts prepared for the purpose. In a line carrying a heavy current the reactance is usually several times the resistance drop. Using the circuit already spoken of under (c), the resistance drop is about 2 per cent and the reactance drop about 8 per cent, but the total drop is only 7 per cent, which on a 440 volt line would be 31 volts. This means that the generator would have to be run at 471 volts to deliver a pressure of 440 volts at the end of the line.

Now both of these drops and their resultant, which is the actual loss of voltage, vary with the current, but not in a simple ratio. If the power factor had been 100 per cent, the current would have been 80 per cent of the value given, or 736 amperes. At unity power factor the influence of the reactance drop on the actual voltage loss almost vanishes for cases like the one we are considering, and in this particular instance the voltage loss at 100 per cent power factor for the same loss in kilowatts would be only 1.7 per cent, which would amount to $440 \times .017 = 7.48$ volts as compared to the original drop of 31 volts, or a gain of 23.5 volts. This may not seem great, but it should be borne in mind that the starting and maximum running torques of an induction motor vary inversely as the square of the voltage, and the current drawn by such a motor running under constant load varies almost inversely as the voltage, and so it is important to keep the pressure at the terminals of fully loaded motors up to normal.

The facts just brought out apply particularly to short lines at moderate voltage carrying heavy currents on conductors placed close together. They do not apply without modification to long high tension circuits with wires spaced several feet apart.

In General

In this discussion no attempt has been made to bring out every item that is affected by low power factor, since it was desired to emphasize the financial rather than the scientific side of the question. It is apparent, however, that improvement in power factor is worth a careful analysis, since it may and probably will result in an actual increase in earnings.

State Cement Plant Is Object of Inquiry

Jackson, Mich.—Gov. Alex J. Groesbeck has issued orders that the circumstances of the sale of the cement plant at Chelsea to the state for $500,000 be sifted to the bottom, according to word reaching Jackson.

The one-man grand jury, instituted upon resolution of the State Administration Board and called by Circuit Judge Benjamin Williams following the filing of a bill of complaint, was to reconvene this morning. Every person who had anything to say about the purchase of the Chelsea plant is being sought, it is understood.

Edward Frensdorf, former Democratic candidate for governor, who has had considerable to say against the State Administration Board, the governor and the Republican State Central Committee, was expected to be a witness sometime this week. Mr. Frensdorf is quoted as saying the cement plant could have been bought in 1910 for $90,000. It was hinted yesterday that heads of several cement manufacturing plants will be called in to determine the true value of the plant at the time it was purchased. It is understood the state at the time had some competition and that Governor Groesbeck employed an investigator to look into the value of the plant and equipment before it was purchased.—*Detroit News.*

At the annual meeting of the stockholders of the "Societe Mediterranenne des Chaux et Ciments Artificiels" (Mediterranean Lime and Artificial Portland Cement Company) a dividend of 6% was declared. They announce that their plant at Grave, near Nice, has resumed operations.

Important Decision Expected on Railroad Service

The Missouri Pacific Railroad's application to construct an extension from its line near Kincaid 2.8 miles to the plant of the Great Western Portland Cement Co., near Mildred, Kansas, still is pending on the docket of the Interstate Commerce Commission. The cement company has intervened in support of the railroad's project and the Missouri-Kansas-Texas Railroad has intervened in opposition thereto as that system now serves the plant.

The Missouri Pacific and the cement company represent that the service of another line would be beneficial to the mill in times of car shortage. The M.-K.-T. contends, on the other hand, that this would not follow and that the service rendered by its line to the plant has been entirely adequate. The Commission was informed that the new line would result purely in duplication of facilities and that the revenues derived, estimated at $200,0000, would result in the subtraction of that amount from M.-K.-T. earnings.

The Missouri Pacific represented, on the other hand, that the earnings of the projected line during the first year of operation would amount to $230,000 and that only 25 per cent of this would represent diversion from the M.-K.-T. The Missouri Pacific's application to construct the line was filed last September but due to delay on the part of the Kansas Public Service Commission, which was requested by the I. C. C. to conduct the case, it was not set down for hearing until April 21. A hearing was scheduled before the State Commission at Kansas City on that date.

This case presents a question, the decision on which will be interesting to all industrial plants, viz., whether or not a plant is entitled to the service of more than one line of railroad.

Men and Mills

Notes from the Field

New Cement Plant in Northwest

For the purpose of devoting their attention to organizing the Northwestern Portland Cement Co. whose manufacturing plant will be on the Skykomish river, east of Everett, Wash., George Macdonald, vice president and manager, and C. T. W. Hollister, secretary and sales manager of the Sun Portland Cement Co. have resigned. H. L. Knappenberger, manager of the Sun plant at Lime, Eastern Oregon, has assumed the position of general manager. The Sun sales management has been taken over by E. E. Le Claire, for a long period associated with the sales department of the Oregon Portland Cement Co. at Oswego, Ore. Several Portland men financially interested in the Oregon company are shareholders also in the Sun company. They are among the heavy holders in the new Northwestern Cement company. Macdonald and Hollister have opened an office on the fourth floor of the Wilcox building in Portland, Oregon.

R. P. Butchart, one of the foremost industrial captains of British Columbia and a large factor in the Oregon Portland Cement Co. at Oswego and the Sun Portland Cement Co. successfully operating at Lime, in Baker county, Oregon, denies that he is interested in the Northwestern Portland Cement Co. Butchart regards the Northwestern company's project as competitive with his Oregon companies, a statement from Portland says.

According to an announcement attributed Charles L. Hall, President of the Hermitage Portland Cement Co., Nashville, Tenn., his company will build a large cement mill, with two units, in Alabama. The main plant will be located at St. Stephens, Ala., on the Tombigbee river, and the shipping unit at Mobile, Ala., whence the product will be shipped to New Orleans, La., and Tampa, Fla., for reshipment over the territory.

According to the announcement the board of directors of this new mill will include prominent men from Tampa, Fla., Chattanooga, Tenn., and Mobile, Ala. The company has obtained water frontage in Mobile through Harry W. Matthews, president of the Gulf Coast Investment Co., and a well known realtor of Birmingham, Ala.

At a special meeting of the stockholders of the Nazareth Cement Co., Nazareth, Pa., at the general office of the company, the stockholders present voted in favor of converting all of the company's stock now outstanding, consisting of 7500 shares of preferred stock of the par value of $750,000 and 7500 shares of common stock of the par value of $750,000 into one class or kind of stock consisting of 157,500 shares of no par value by giving to each holder of the present preferred stock eleven shares of stock of no par value in exchange for each share held of the present preferred stock and by giving to each holder of the present common stock, ten shares of stock of no par value in exchange for each share held of the present common stock.

The U. S. Supreme Court on April 13 reversed a decision of the U. S. District Court for the Eastern District of Michigan dismissing an indictment under the Elkins Act against the Michigan Portland Cement Co. for obtaining false preference in the movement of railroad cars.

Shareholders of the Beaver Portland Cement Co. met in annual session at the company's office in the Porter building to receive reports for 1925 and to elect officers for the ensuing year. Directors were re-elected and in turn re-elected officers, who are: D. L. Carpenter, president; W. H. Muirhead, vice president; L. H. Adams, secretary-treasurer; Buell C. Nelson, assistant secretary, these with William Schrump composing the board.

Reports showed the new year is starting with a large supply of clinker and cement at the plant at Gold Hill, in Southern Oregon; that improvements made to the plant will insure more efficient and economical operation; that the new kiln dryer is complete; that the new rock quarrying system is working smoothly, and that prospects for this year are encouraging from both production and marketing standpoints.

It is estimated that this year's output of Portland cement will be close to 400,000 barrels, which, when marketed, will add appreciably to the company's revenues. All earnings last year went into improvements and accumulation of surplus from which dividends will be paid ultimately, the president reported.

The Southern Kansas Industrial Belt Railway filed application with the Interstate Commerce Commission on April 13 requesting authority to construct a line to provide adequate switching and interchange service at Fredonia, Kansas. The projected line would be 3.858 miles in length and would serve the Fredonia Portland Cement Co., and other industrial plants.

"An index of the growth of the south is found in the increased consumption of cement, which with steel, is an accurate barometer of industrial conditions," declared H. C. Koch, vice-president of the International Cement Corporation, while on a visit to the plant of the company at Birmingham, Ala.

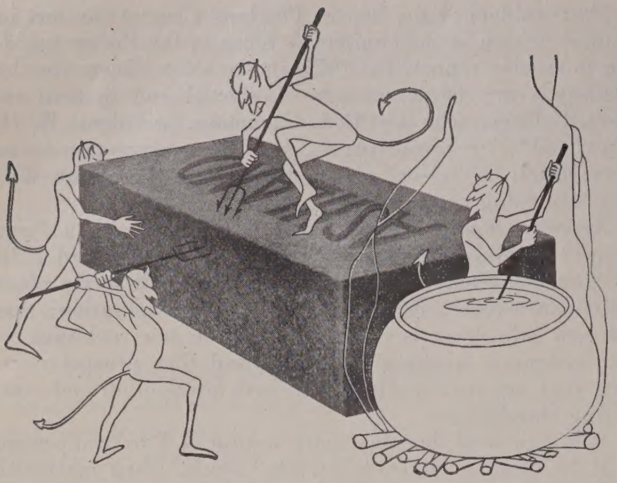
The International Cement Corporation recently acquired the Birmingham plant of the Phoenix Portland Cement Co., of Birmingham, Ala., which is now operated by the International Cement Corporation as the Alabama Portland Cement Co.

"In the last five years cement consumption in Alabama and adjacent states has increased approximately 119 %," Mr. Koch said, although it is equally as interesting to note that in the same period the productive capacity of cement mills in the south has increased nearly 300%."

Continuing he said: "Everyone interested in the cement business, whether as a manufacturer, investor or consumer, should carefully consider the facts presented in the report of cement production and consumption for 1925, which has just been issued by the government. This report shows that the south as a whole consumed approximately 16,000,000 barrels of cement. Of this total about 3,000,000 barrels were shipped into the south from Pennsylvania and other states."

Conditions in Birmingham, according to Mr. Koch, are most reassuring and indications are the entire industrial district will continue to experience a period of steady production in all lines.

At the annual meeting of the stockholders of the Coplay Cement Company, Coplay, Pa., the president, H. E. Steiner, reported that in 1925 the company had manufactured nearly 2,000,000 barrels of cement and that the prospects for 1926 were good. The following directors were elected: Abraham Israel, James J. Burns and Harry Woolever, Philadelphia; Eugene Blum, H. E. Steiner, Sol Korn, L. H. Burton, Morris Meyer, Walter J. Wolf, B. J. Weil and L. M. Loeb, New York; E. F. Meyer, Chicago, and G. W. Newgarten, Washington.



The Invisible Costs In Your Furnace Lining

Every time you line a furnace you pile up two invisible costs in addition to the easily seen cost of the brick itself.

First, the cost of temporary delays and possible shutdowns.

Second, the cost of labor, by far the biggest cost of all.

No brick made can entirely eliminate these invisible costs. But there is a brick whose resistance to the little devils of high temperature renders them much less formidable.

If you want to prove for yourself the economy of Ashland, the fire brick that lasts, write us what you are up against.

ASHLAND FIRE BRICK CO.
Incorporated *1886*
ASHLAND, KENTUCKY
Manufacturers Of Sized Brick

SALES OFFICES
New York Cleveland Chicago Detroit
Indianapolis Havana, Cuba

Asano Company to Enter Hawaiian Cement Market

The Asano Portland Cement Co. of Japan has decided to enter the market in the Hawaiian Islands. This concern, which recently completed a survey of the field in America's mid-Pacific possessions, is the largest of its kind in Japan and exports between 800,000 and 900,000 barrels of cement annually, about 70% of the Empire's exports of the commodity.

The firm's markets have hitherto been in South China, French Indo-China, Java, Borneo and other points in the East Indies. It is, however, much impressed with the possibilities of Hawaii and negotiations are proceeding with the Nippon Yusen Kaisha for favorable freight rates. Hawaii now imports principally from the United States, Norway and Sweden, with the first far in the lead.

Industrial Literature

The New Republic Motor Driven CO_2 Recorder is the title of a folder issued by the Republic Flow Meters Co., Chicago, Ill., describing and illustrating the company's latest development in the field of fuel economy.

It is stated that the instruments supplied up to the present time in the way of CO_2 recorders have been operated by city water pressure. This is reported to have given excellent satisfaction except in localities having bad water, causing stoppages, etc. For this reason the motor driven instrument has been developed.

Perfect combustion is defined in the fiolder and the method of operation of the recorder explained.

Sand and Gravel in 1924, is a bulletin recently published by the Bureau of Mines. While the data comprises nothing more recent than the year mentioned, yet it is the latest available, and gives some very interesting statistics upon the geographical distribution of the production of aggregates and special sands. Copies may be secured at a nominal cost from the Superintendent of Public Documents, Government Printing Office, Washington, D. C.

Gypsum in 1924, is the title of a pamphlet recently received from the Superintendent of Public Documents, Government Printing Office, Washington, D. C. This publication of the Bureau of Mines now makes available the complete statistics of the production of gypsum up to and during the year named. It contains a list of gypsum mines and of the manufacturers of various gypsum products, together with a short chapter upon the uses of gypsum.

The Foote Bros. Gear and Machine Co., 215 N. Curtis St., Chicago, have just announced a new general catalog which will be off the press by the middle of May. This catalog will contain a complete price list of the company's spur and worm gear speed reducers, flexible couplings, sprockets and gears of all kinds, together with engineering data of interest.

The Technology of the Manufacture of Gypsum Products.—Because of the large increase in the value of the crude and calcined gypsum produced in the United States, which has risen from $2,750,000, representing a tonnage of less than 1,000,000, to $40,000,000 representing more than 5,000,000 tons in 1924, public interest has been stimulated in this product and the Bureau of Standards has been receiving an increasing number of inquiries relative to various phases of the technology of gypsum manufacture.

These requests have been considered by the Bureau to be sufficiently numerous to warrant a publication covering the subject. To obtain the necessary data for such a paper 23 representative gypsum mills located at several of the larger gypsum deposits were selected and visited, and a general description of each is included in an appendix to the paper which was prepared. The object of the field work was to obtain complete information about the process of manufacture of calcined gypsum and gypsum products; to study the methods of mining or quarrying, and crushing; to select typical samples of the raw material for analysis; to observe the methods of calcination, temperatures, and duration of calcination; to study the methods of sampling the calcined product; to follow this through the process of grinding, screening, and packing; and, finally, to observe the methods of manufacture of products made from calcined gypsum. The equipment employed and the processes used are correlated and compared.

The results of this investigation are described in Circular No. 281 of the Bureau of Standards, which has just been issued.